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EP 0378361 A

US 4871163 A

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(54) Abstract Title

Sheet handling apparatus with diverter

(57) Sheet handling apparatus comprises sheet cutting and folding devices for cutting and folding sheets in accordance with a selected mode of operation of the apparatus, a sheet diverter (5) pivotable between different settings for directing sheets from the processing means in different discharge directions (O, U, S), and a motor (6) drivingly coupled to a pivot axle (25) of the diverter. The motor (6) is mechanically separate from a main drive of the apparatus, but is controlled by a regulating device (24) in dependence on signals indicative of essential parameters of the apparatus, in particular signals provided by a sensor (19) sensing the phase position of sheets fed to the diverter, a setter (20) setting the mode of operation of the apparatus, a speed sensor (21) sensing the rotational speed of the main drive and sensors (22, 23) detecting blockages in the paths associated with two of the discharge directions (O, U).

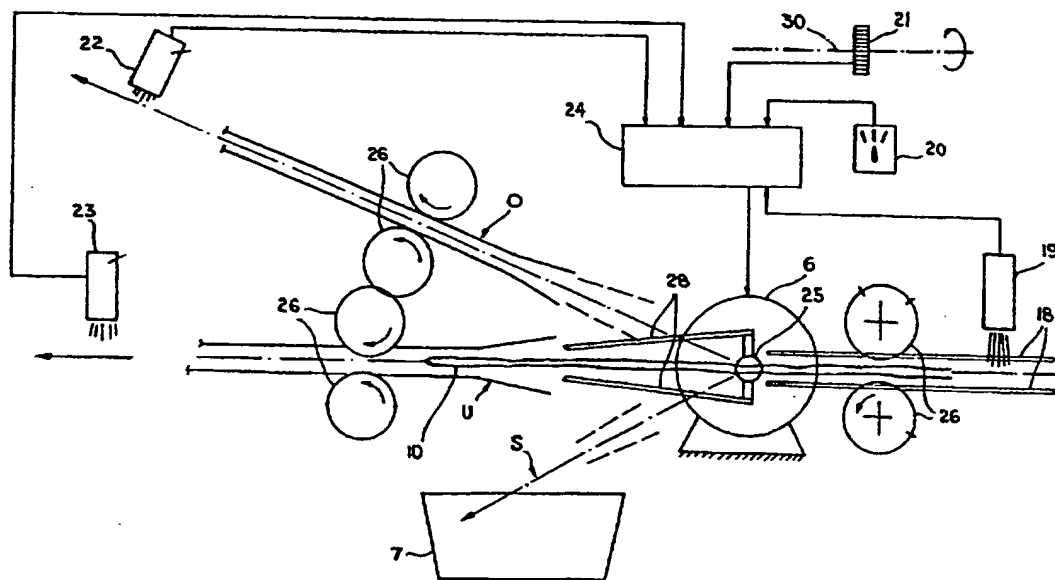


FIG.2

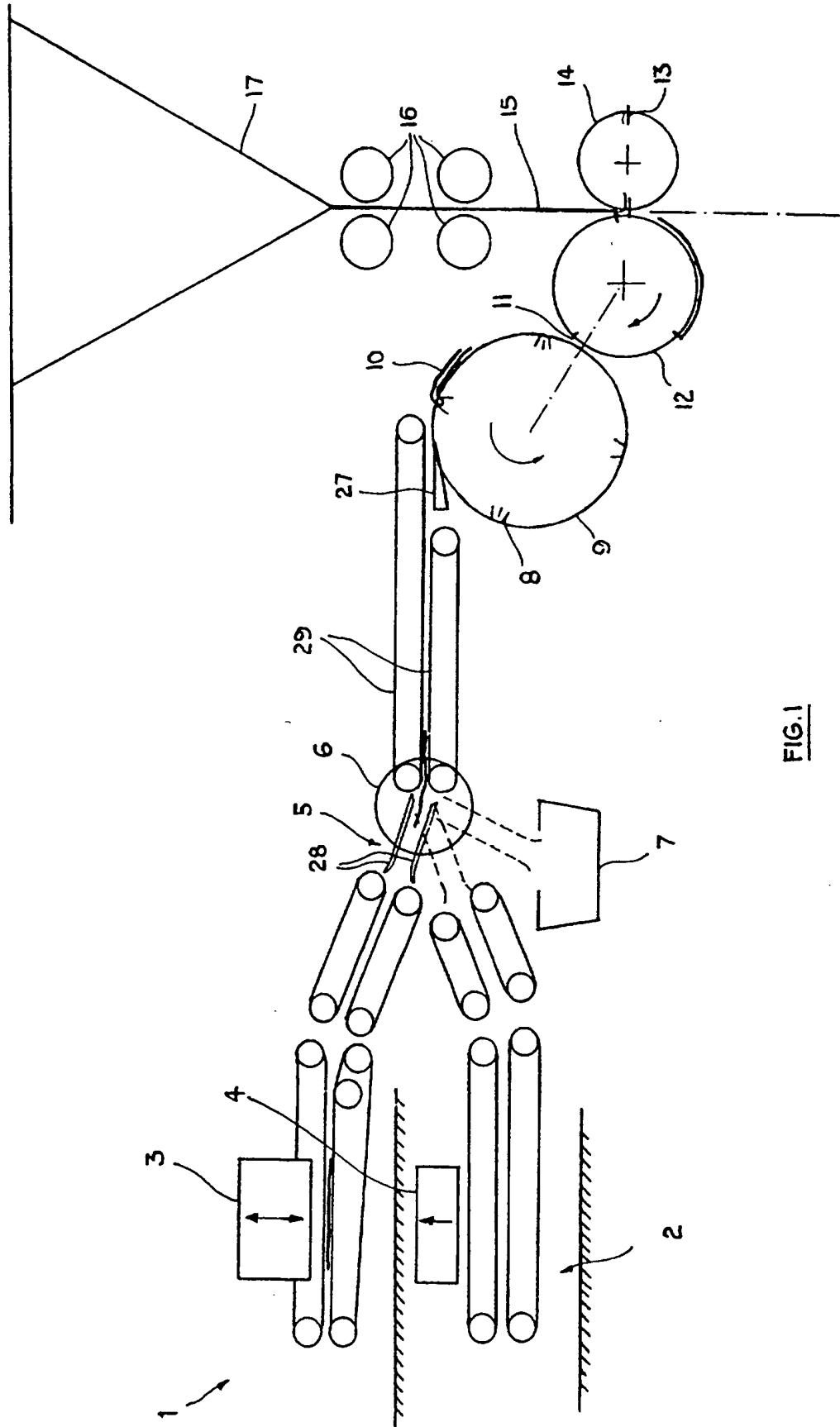


FIG.1

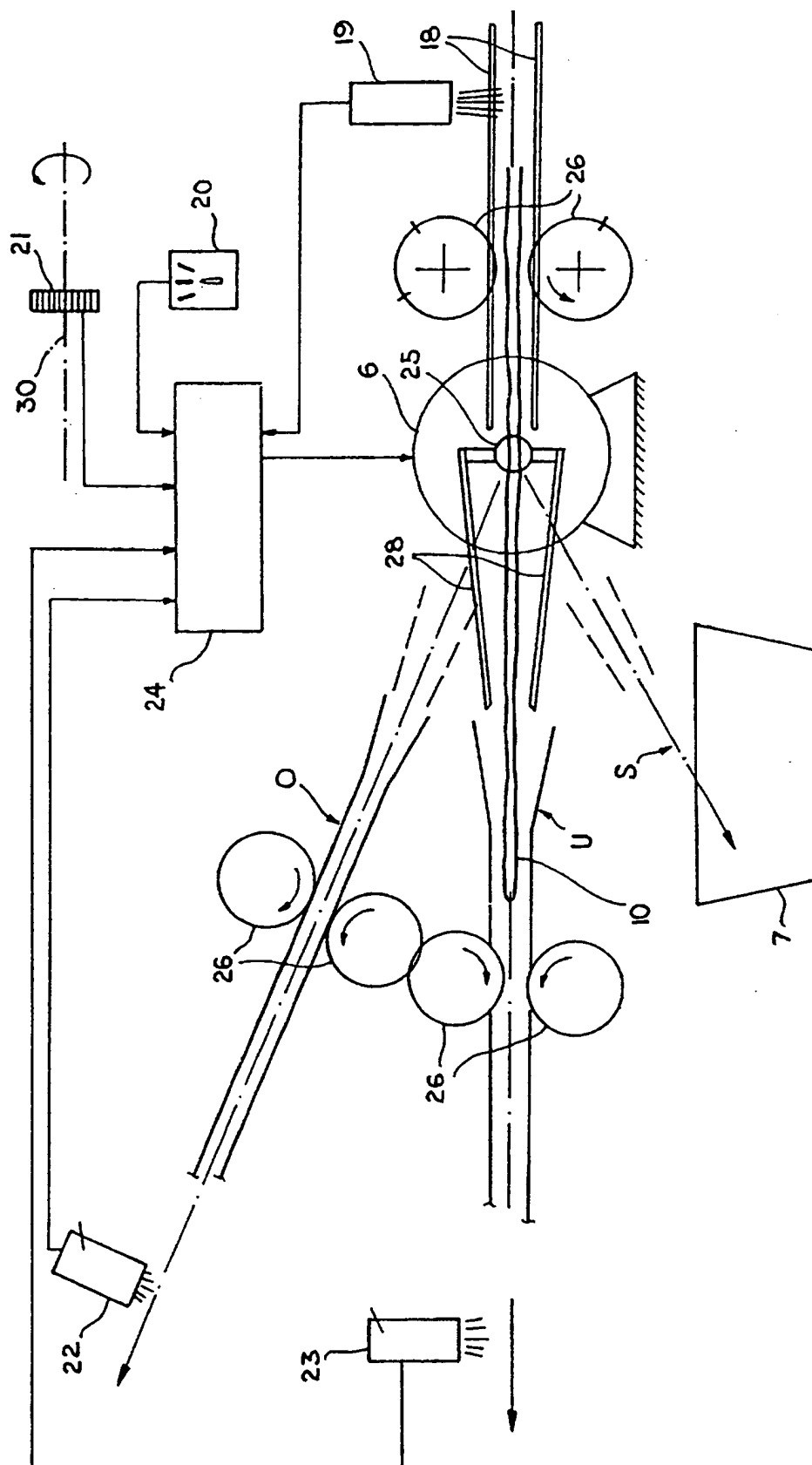


FIG. 2

### SHEET HANDLING APPARATUS

The present invention relates to sheet handling apparatus for handling sheets and/or folded products, in the nature of sheets, for example, within a printing machine with folding devices disposed one above the other.

Diverter are known which, after appropriate setting and fixing, can guide all products along a single path. Further, diverters are known which can feed, in alternation, the sections of additional downstream folding devices, and sheet-by-sheet depositing devices, in storeys. Moreover, diverters are known which can be fixed or operate in alternating manner after resetting. Also known are diverters which, in the case of occurrence of paper waste or of blockages, immediately conduct away the products to another path, in order to protect the components of downstream folding equipment from damage by the accumulating paper.

Thus, in DD-PS 246 524 there is described a fixable and alternately operating diverter which also functions as a waste paper diverter and is controlled by a cam gear mechanism. A cam disc is connected with the drive of the machine in cyclic manner by way of gearwheels. If only one conveying direction is to be permitted, the function of the cam gear mechanism operating as a diverter drive has to be cancelled. This is effected in known manner by means of two electromagnets or manually operable setting spindles, by which a cam lever is kept constantly lifted off a cam track for a first diverter setting and thus is independent of the rotating cam disc. For a second diverter setting, the electromagnets or setting spindles are set so that the rotational axis of the cam disc is displaced and consequently the cam lever adopts the setting for the second conveying direction, similarly independently of the rotating cam disc. Through appropriate setting of the electromagnets, two further positions are provided, which can be used in the case of blockages.

However, due to the two electromagnets, switching lever, gearwheels, cam disc and roller lever, a relatively large number of parts and a relatively large amount of space are necessary. Moreover, a suitable cyclic drive for the cam disc is not always present in the vicinity of a new diverter to be provided. The cam gear of the diverter imposes a cyclic sequence with respect to product distribution which is virtually invariable. However, it is often desired to provide, for example, a twin-flow product delivery in collecting operation.

This obliges a halving of the cyclic sequence with respect to the product sequence, which cannot be realised with a diverter drive which does not work in the machine cycle. An additional switching gear for halving the cam disc rotational speed would increase cost even further.

There is thus a need for a variably controllable and regulable product diverter which can operate in correspondence with preset modes of production such as collecting production or double production, is introducible into the conveying flow at any location independently of cyclically-obliged rotational speeds and without additional gearwheels, toothed belts or the like, has a low noise level, requires only a small number of parts and a small amount of space, and can operate in space-saving manner as a waste paper or blockage diverter.

According to the present invention there is provided a device for controlling/regulating a product diverter for the conducting on of folded products, in particular in a folding apparatus at a roller rotation machine, for fixing the conveying direction to further folding devices as well as for the separating out or diverting of folded products particularly in the case of blockages, characterised in that at least one blockage sensor detecting blockage of one discharge direction of the product diverter, at least one blockage sensor detecting blockage of the other discharge direction of the product diverter, at least one phase position sensor detecting the product phase position, a rotational speed sensor detecting the rotational speed of a main drive and a switching device presetting the mode of production are connected with a regulating device producing the corresponding cycle frequency and phase position relative to the product or the fixing in at least one rest setting and the regulating device is arranged downstream of a motor connected with an axle of the product diverter.

Preferably, the motor is a stepping motor and, for example, is directly coupled with the diverter axle. Expediently, the regulating device is so constructed that it presets the appropriate cycle frequency and phase setting relative to the product or the fixing in at least one rest setting by means of detected rotational speed parameters, signals relative to the phase position of the products and signals relative to the actual mode of production referred to intake operation and reversing operation as well as collecting production or double production.

Thus, in apparatus embodying the invention the product diverter is driven by at least one electrically controlled/regulated drive, such as a stepping motor, from the main drive of, for example, a printing machine and/or folding apparatus in the case of alternating operation, which can take over all necessary control tasks such as pivot movement, fixing, operations according to product. For that purpose the motor receives, from the printing machine, control signals which during alternating operation guarantee synchronism relative to the machine speed and relative to the product sequence exact in phase. In intake operation, the step position of the motor rotor can be held fast by the holding moment due to electrical direct current excitation of the winding. The product path is correspondingly defined, thus the diverter fixed in an upper or lower setting. In the case of blockages, an appropriate diverter movement for an additional product path can be executed. If a blockage arises during intake operation, under appropriate preconditions a diversion to the unused path can even take place without stopping of the machine. Preferably, the motor is directly coupled with the diverter axle. Through the described arrangement, the usual conglomeration of diverse means for the control of the diverter can be eliminated. Gearwheels, which are required for rotation of the cam disc, are dispensed with, the cam disc, which is required for the high-frequency oscillation of the diverter in alternating operation, is dispensed with, the electromagnets, which are required for the fixing of the diverter in intake operation and during blockages, are dispensed with and the switching lever and locking mechanism, which are required for necessary movement play of the cam lever in each instance, are dispensed with. All tasks can be taken over by a stepping motor, which is subject to a control/regulation referred to the particular operating mode and conditions.

An embodiment of the invention will now be more particularly described by way of example with reference to the accompanying drawings, in which

Fig. 1 is a schematic overall view of a folding apparatus embodying the invention;  
and

Fig. 2 is a schematic side view, to enlarged scale, of a product diverter in the apparatus of Fig. 1.

Referring now to the drawings, there is shown folding apparatus which is operable in a selectable one of a plurality of different modes and in which a printed paper web 15, drawn

by pull rollers 16, is initially longitudinally folded or longitudinally cut at a fold funnel 17. Separation of products 10 from the web 15 is effected by cutting knives 13 of a knife cylinder 14. Directly after the cutting process the products are engaged by puncturing on needles 11 of a collecting cylinder 12, which, through further rotation, conducts the products to a folding blade cylinder 9, where a first transverse fold is performed by means of folding knives and folding blades 8. After the folding process, the products are taken off the cylinder 9 by opening of the blades 8 and by means of deflectors 27 and are fed to a product diverter 5 by means of conveyor belts 29. Downstream of the diverter 5 are two folding units 1 and 2, which are arranged one above the other respectively at the end of an upper discharge path O and the end of a lower discharge path U and which serve for forming respective second longitudinal folds by folding knives 3 and 4. According to the selected mode of production and technical preconditions, either or both devices 1 and 2 can be used. Simultaneous use of the devices 1 and 2 in general enables a substantially higher web speed and printing output. For this purpose it is necessary to distribute the arriving products by means of the diverter 5 to the two devices 1 and 2 in alternation, analogously to a slide fastener action. Guides 18, for example in the form of tongues, conduct the products to the diverter 5 for feeding to the two folding devices 1 and 2. These products are checked at an axle 25 of the diverter, which axle is directly connected with a stepping motor 6 which causes the pivot movement of guide plates 28 of the diverter or fixes them in one conveying direction. For that purpose, the motor 6 receives control signals from a control/regulating device 24. This in turn receives data from a phase position sensor 19, a switch 20 determining mode of production, a rotational speed sensor 21 associated with a longitudinal shaft 30, and blockage sensors 22 and 23 with respect to instantaneous cycle rotational speed, phase position of the products, mode of production, such as intake operation below or above, reversing operation, collecting production or double production, and presence of blockages in the paths O and U. The regulating device 24 is connected with the machine monitoring system, so that in the case of blockages the diverter 5 can be correspondingly actuated. After passing the diverter 5, the products are fed by way of conveyor belts and rollers 26 to the folding devices 1 and 2 or, in the case of blockage, are conducted out of the normal product flow in a direction S to a waste paper container 7.

**PATENT CLAIMS**

1. Sheet handling apparatus comprising means for causing the apparatus to operate in a selectable one of a plurality of different modes, processing means for processing sheets in accordance with the selected mode of operation, rotary drive means for driving the processing means, a sheet diverter movable between different settings for directing sheets from the processing means in different discharge directions, a motor drivingly coupled to axle means of the diverter and operable to cause said movement, and control means for controlling the diverter, the control means comprising detecting means for detecting and providing signals indicative of the selected operating mode, the rotational speed of the rotary drive means, the phase position of sheets fed from the processing means to the diverter and the presence of sheet blockage in the or at least two of the discharge directions of the diverter and a regulating device for regulating the motor in dependence on the signals to control movement of the diverter between and fixing of the diverter in said settings.
2. Apparatus as claimed in claim 1, the processing means comprising a fold-forming device for forming folds in the sheets.
3. Apparatus as claimed in claim 2, comprising further fold-forming devices and a sheet deposit respectively associated with the discharge directions.
4. Apparatus as claimed in any one of the preceding claims, wherein the motor comprises a stepping motor.
5. Apparatus as claimed in any one of the preceding claims, wherein the motor is directly connected to the axle means.
6. Apparatus as claimed in any one of the preceding claims, wherein the regulating device is arranged to control the motor to cause the diverter to be moved between at least two of the settings at a frequency and in a phase determined in dependence on the signals or to be fixed in a setting determined in dependence on the signals.



7. Apparatus as claimed in any one of the preceding claims, wherein the operating modes comprise intake operation, reversing operation, collecting production and double production.

8. Sheet handling apparatus substantially as hereinbefore described with reference to the accompanying drawings.



Application No: GB 9825728.0  
Claims searched: 1

Examiner: Howard Reeve  
Date of search: 2 February 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.Q): B8R (RC)

Int CI (Ed.6): B65H (29/58, /60, /62, /64)

Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0378361 (MITA), see especially column 4 lines 41 - 55	1
A	US 4871163 (LANDA ET AL), see eg figure 1	1

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

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P Document published on or after the declared priority date but before the filing date of this invention.  
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